

Western Aeronautical Test Range

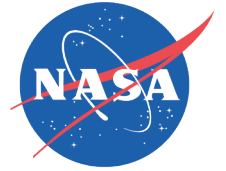


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Presented by: Robert Sakahara



NASA Dryden Flight Research Center

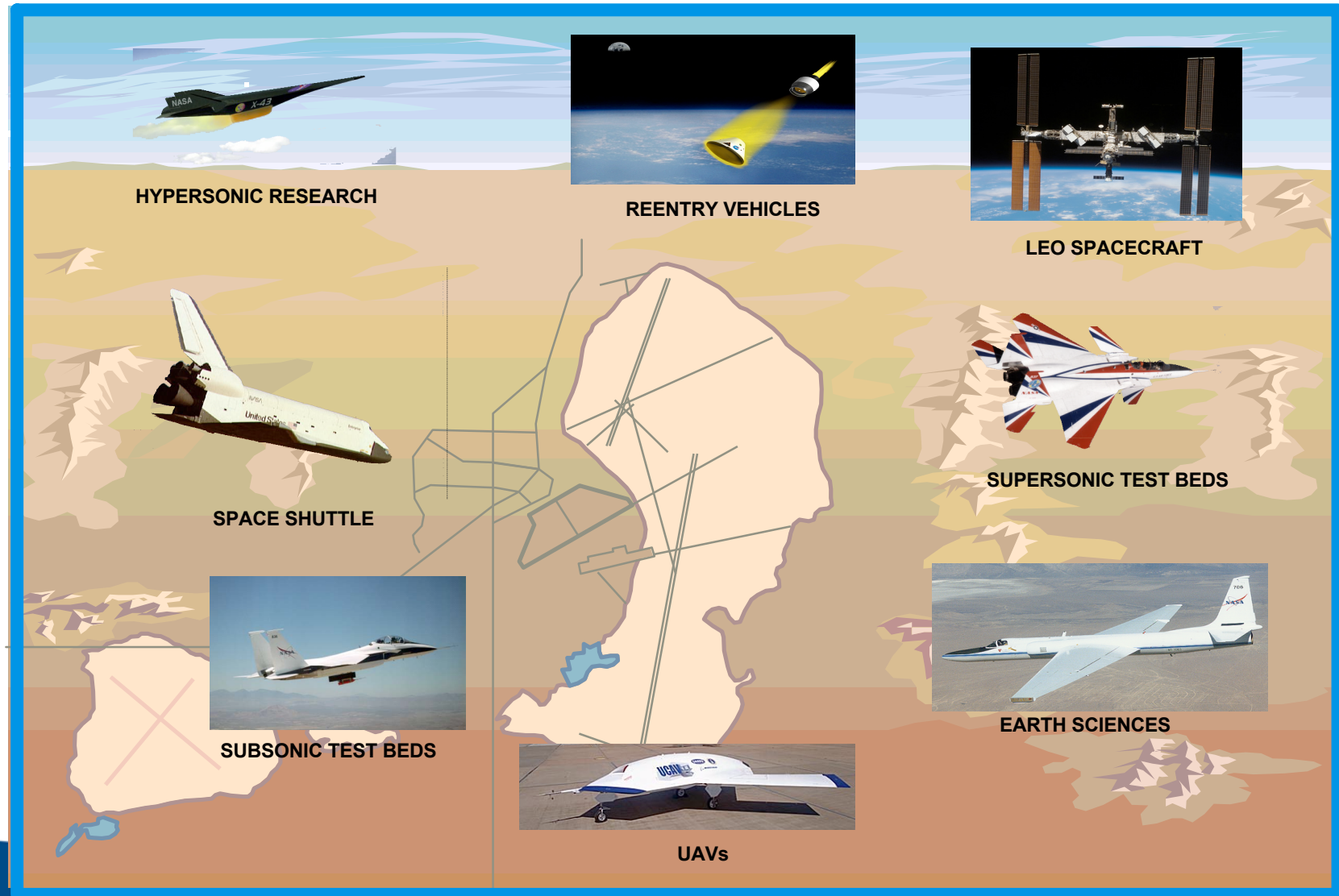


What is the WATR?

- **NASA's Western Aeronautical Test Range (WATR) is a network of facilities used to support aeronautical research, science missions, exploration system concepts, and space operations.**
- **The WATR resides at NASA's Dryden Flight Research Center located at Edwards Air Force Base, California. The WATR is a part of NASA's Corporate Management of Aeronautical Facilities and funded by the Strategic Capability Asset Program (SCAP). It is managed by the Aeronautics Test Program (ATP) of the Aeronautics Research Mission Directorate (ARMD) to provide "the right facility at the right time."**
- **NASA is a tenant on Edwards Air Force Base and has an agreement with the Air Force Flight Test Center to use the land and airspace controlled by the Department of Defense (DoD).**

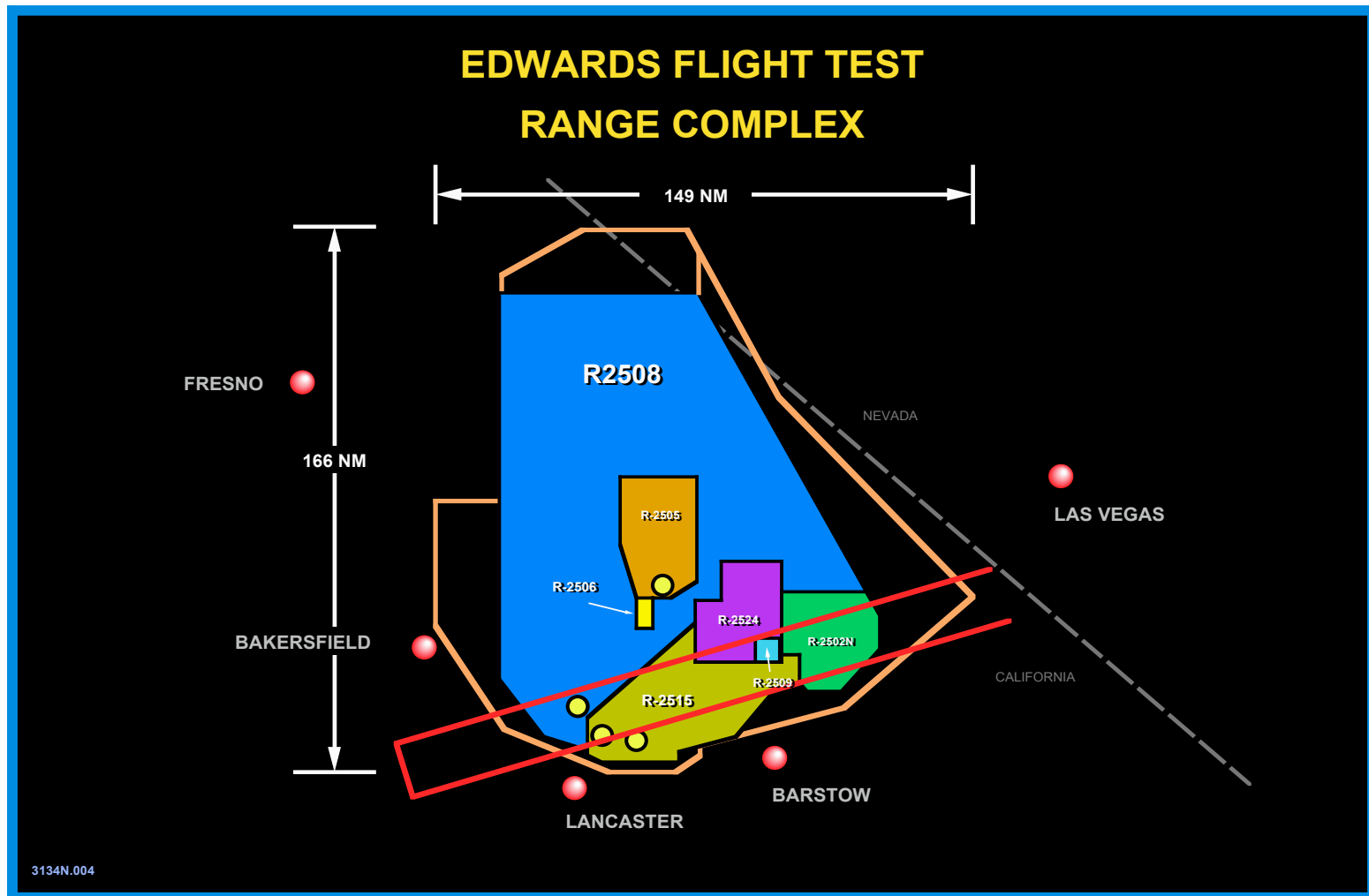


The WATR supports a variety of vehicles



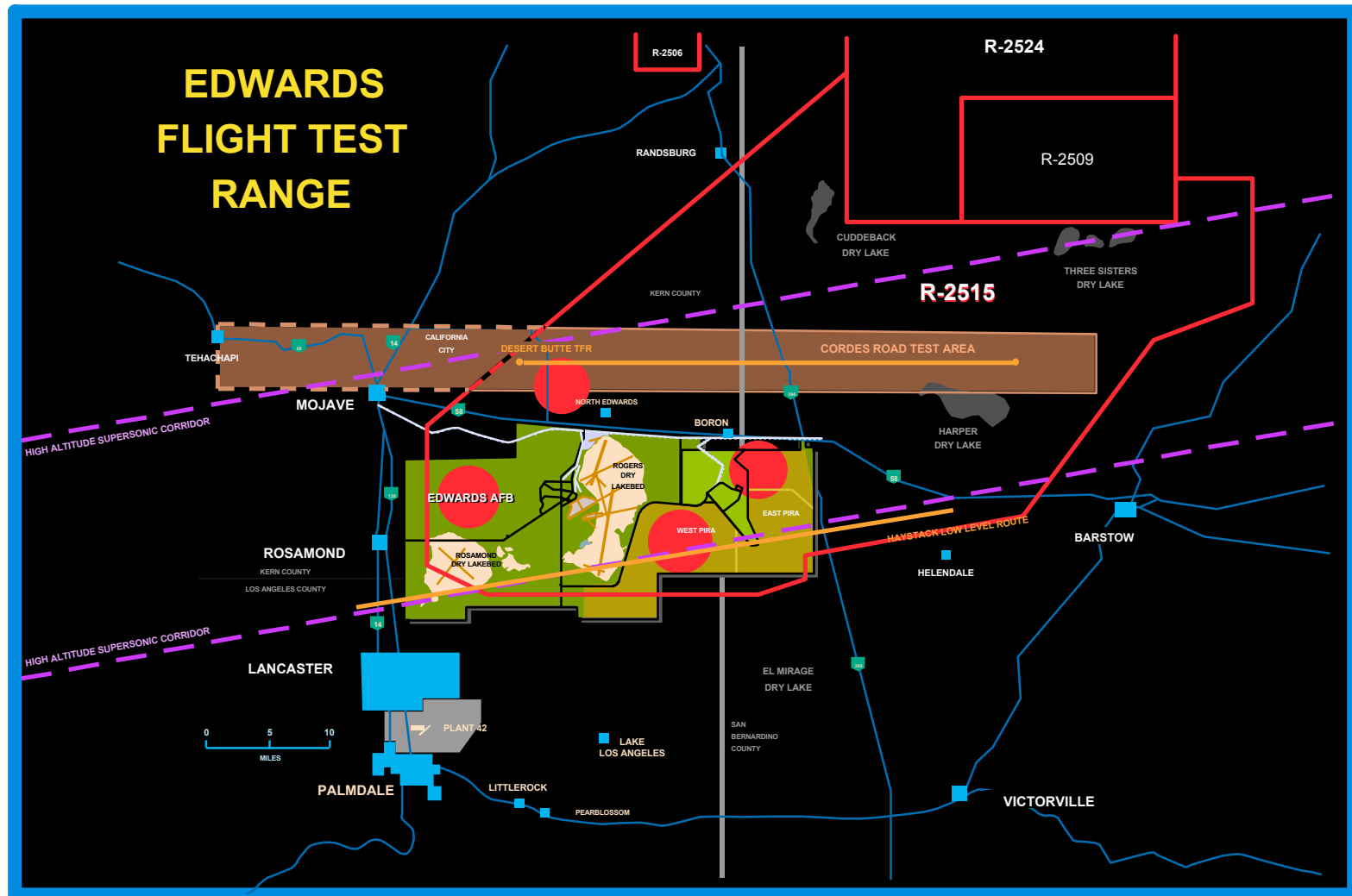
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Dryden shares airspace with the AFFTC ~ 20,000 square miles

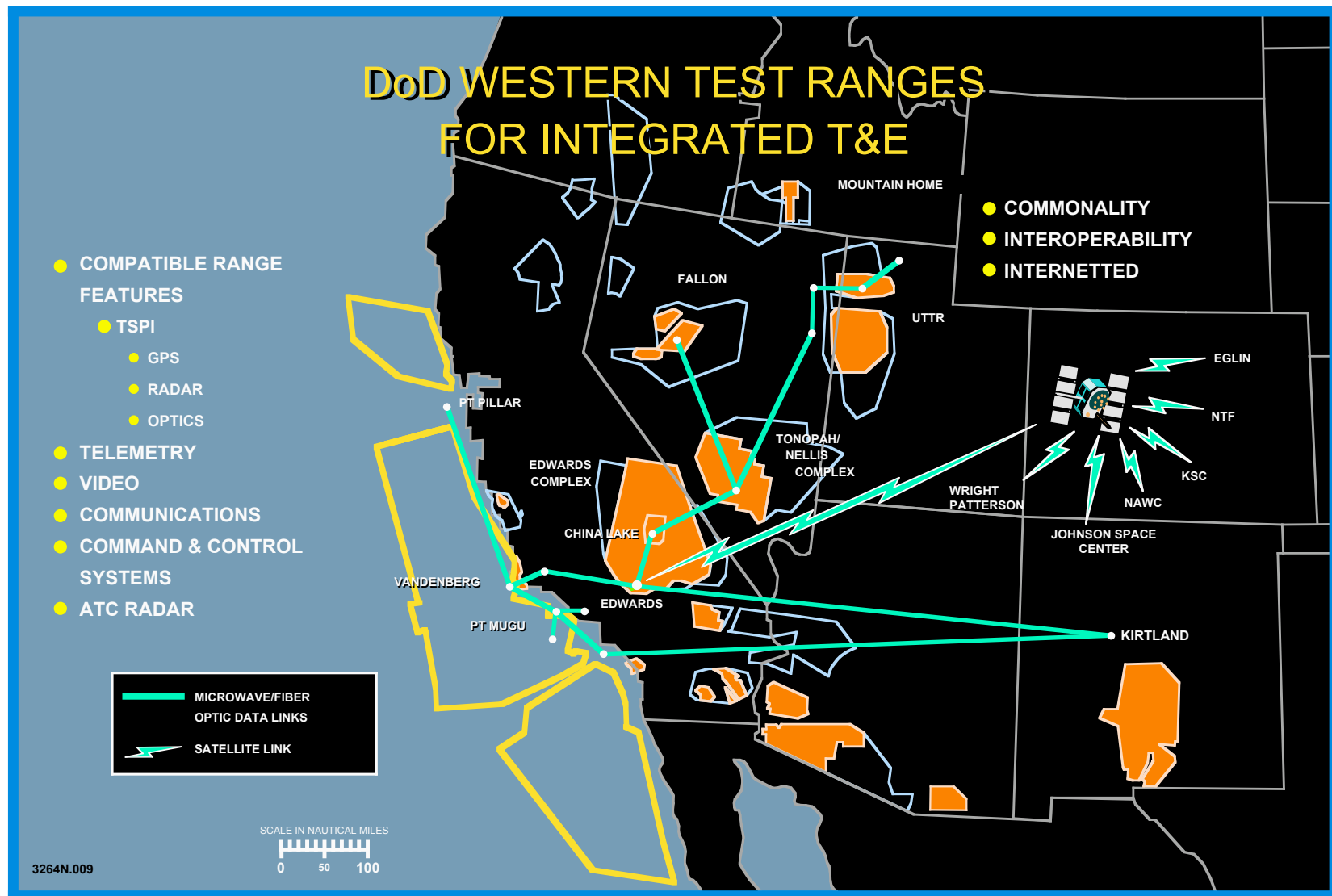


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Restricted airspace, corridors, and special use areas are available for experimental aircraft

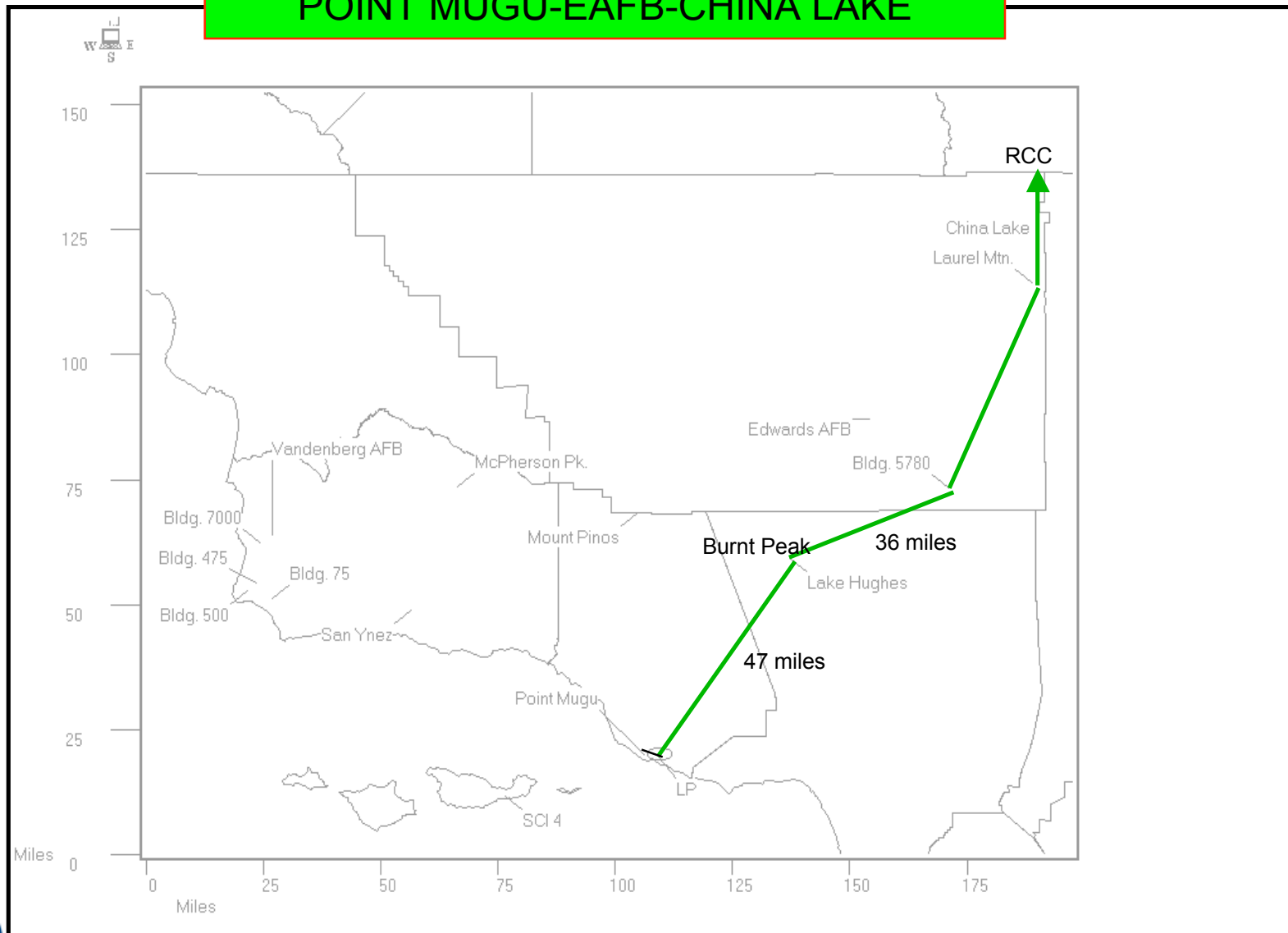


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DIGITAL MICROWAVE LINK BETWEEN POINT MUGU-EAFB-CHINA LAKE

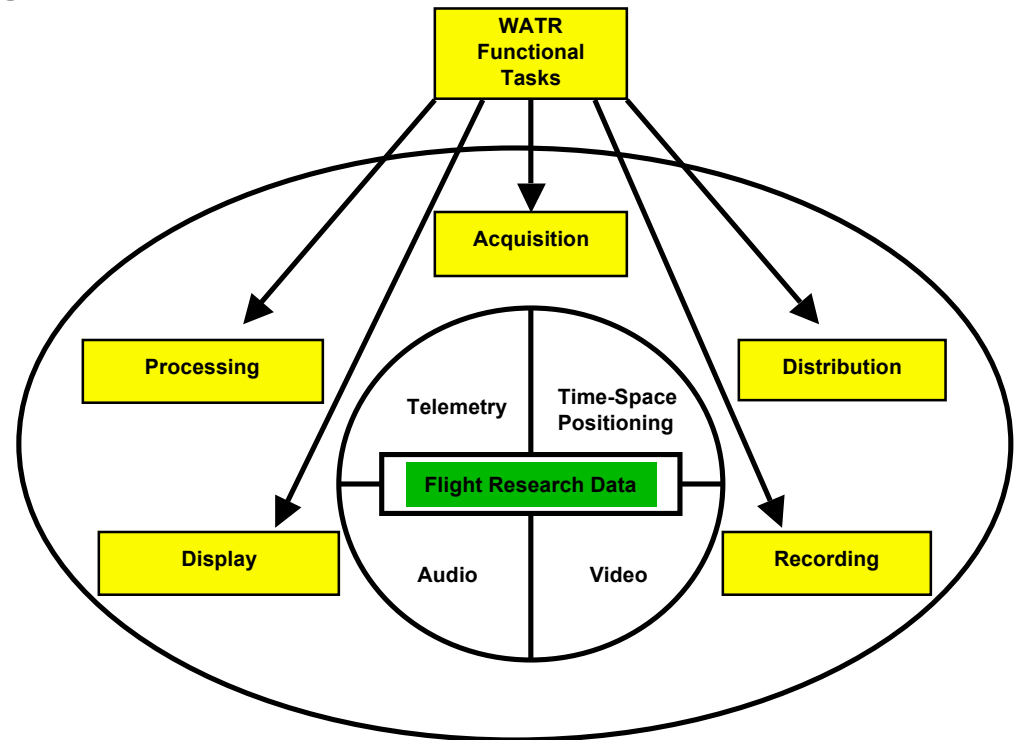


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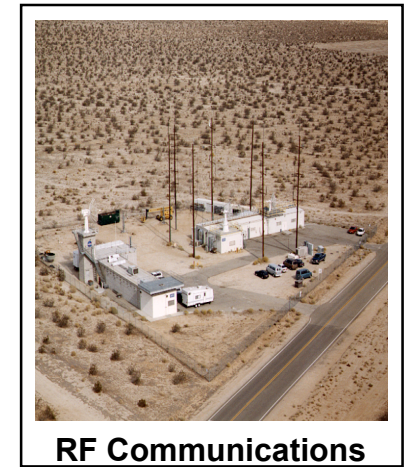
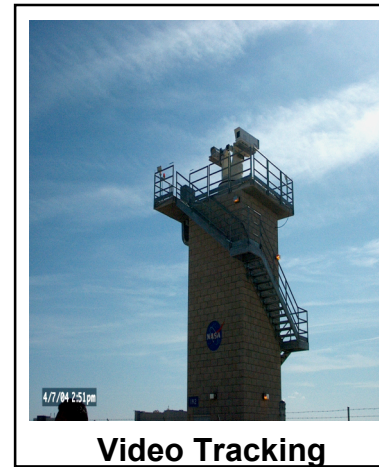
WATR Products and Services

- The WATR provides a full range of engineering and operations services:

- Project requirement definition and analysis
- Project coordination, scheduling, and frequency management
- Algorithm development and/or implementation
- Display definition/development
- Mission conduct and ground systems operation
- Range Safety
- Post-flight data archival and/or processing



WATR Support Configuration



MISSION CONTROL CENTER



Remote User sites



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Telemetry Tracking

- Three fixed C-, L-, and S-band tracking stations and several mobile systems
 - Supports both downlink telemetry and air-to-ground video
 - Command uplink for Space Shuttle, UAVs, RPVs, and piloted vehicles
 - Supports Low Earth Orbiting (LEO) vehicles
- One 9-meter S-band tracking station at Dugway Proving Grounds (Utah)
 - Can support high mach flights



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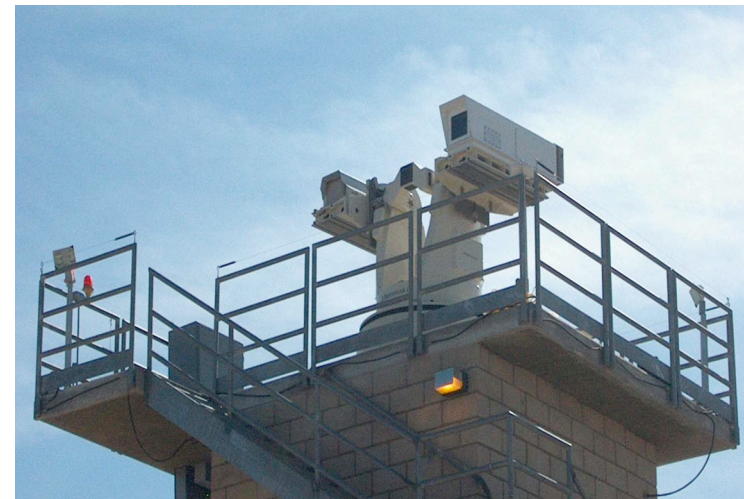
Time Space Positioning

- **Three main types of positioning data**
 - **Precision tracking radars**
 - > High accuracy RIR-716 C-band radars
 - > 3000-nm range within line of sight
 - > Data Enhancement System for highly accurate range and angle information for orbital acquisitions
 - **Global Positioning System (GPS)**
 - > Differential GPS ground station
 - **FAA radar data**
 - > Provided via the Air Force Flight Test enter Center



Video

- Video tracking, distribution, and recording
 - Long Range Optical (LRO) tracking systems for visual contact with test vehicle
 - > High-definition, broadcast quality video for data analysis and network feeds
 - > Forward Looking Infra-Red (FLIR) for night missions
 - > High powered telescope to view distant targets
 - Cameras providing ramp and runway coverage
 - Mobile TV vans for video tracking remote operations (microwaved to control room)
 - Video distribution and recording systems
 - > Up to 256 video sources are routed to both internal and external destinations
 - > Video is recorded on multiple video formats (HD, BETA, VHS, DVD)



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Voice Communication

- **Two-way voice communications with aircraft and spacecraft**
 - UHF, VHF, and HF radios are used as appropriate
 - High-gain directional antennas are used for distant targets
 - Pilots communicate with ground controllers in the Mission Control Center (MCC)
 - Special VHF equipment for communicating with both the Russian spacecraft (Soyuz) and the International Space Station (ISS)
 - Provide data circuits to other NASA centers, DoD facilities, industry partners



Mobile Operations Facilities



MOF 1

- 45-ft semi-trailer
- Equipped with 6-ft telemetry antenna
- L-band uplink capability
- L- and S-band receive
- 7 engineering stations
- UHF/VHF radio and intercom system



MOF 2

- 45-ft semi-trailer
- Equipped with 4-ft telemetry antenna
- Uplink capability
- L- and S-band receive
- Intercom system



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Data Processing

- The WATR mission data processing capability is adaptable to a wide range of unique project needs:

- Handles up to 6 Pulse Code Modulation (PCM) and custom data streams
- Handles up to 1,500,000 samples per second of data
- Handles both telemetry and radar data
- Accommodates complex user computational models
- Provides data archival
- Is available in both fixed and mobile configurations



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Mission Control Center

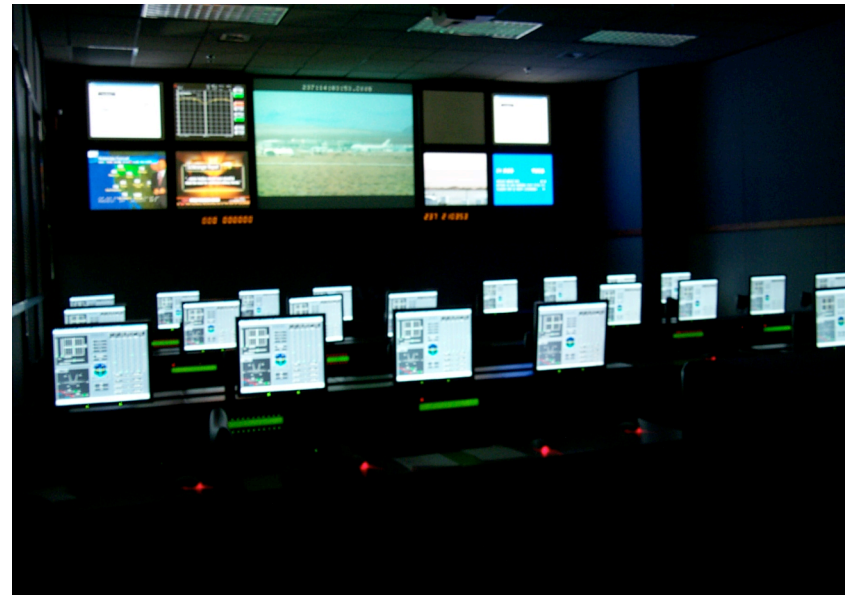
The WATR Mission Control Center provides real-time mission operations for test conductors, research engineers, range safety and other project personnel



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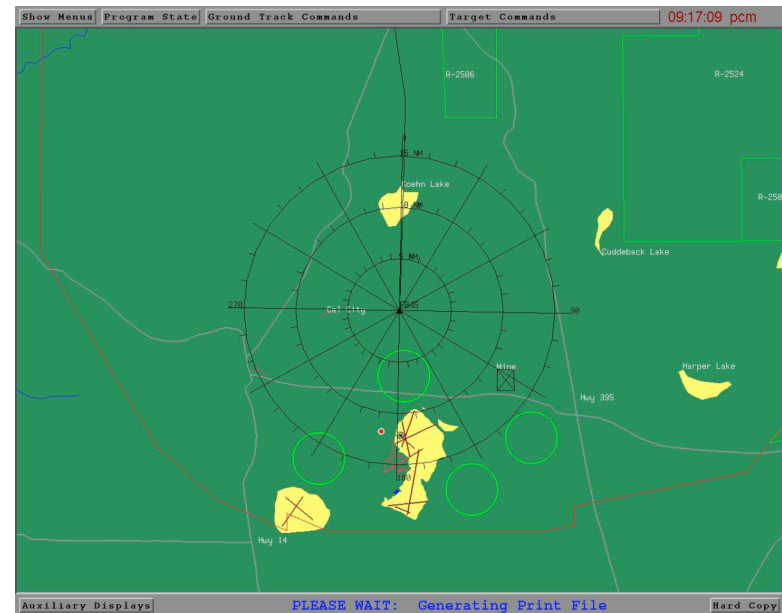
Real-Time Data Analysis

- The WATR provides a set of tools to the project test conductors, engineers, and range safety personnel for:
 - Monitoring of data for flight safety and mission success
 - Additional data analysis for in-flight test point clearance
- A mixture of commercial-off-the-shelf (COTS) and in-house tools are easily configurable to accommodate a variety of mission goals
- Available in both fixed or mobile configuration



Range Safety

- **Public safety and the safety of our pilots and research aircraft are of the highest priority**
 - Range Safety Officers monitor flight critical data as well as time-space positioning data
 - Close attention is paid to vehicle location as well as predicted debris impact points
 - Flight termination system is available for unpiloted vehicles



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